



An epidemiologic investigation of occupational transmission of *Mycobacterium tuberculosis* infection to dental health care personnel

Infection prevention and control implications

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M*ycobacterium tuberculosis*, the organism responsible for tuberculosis (TB), can spread through the air when a person with active pulmonary or laryngeal TB disease coughs, sneezes or sings.¹ Local public health departments have legally mandated responsibilities to prevent and control communicable diseases, including TB, in their communities. To fulfill this role, public health departments conduct TB contact investigations to identify people who have been exposed and people who are infected and might benefit from treatment of latent TB infection (LTBI). TB contact investigations are an essential component of the U.S. strategy for TB control and elimination.

Groups whose risk of developing TB infection is higher than that of the general population include people born outside the United States (hereafter called “foreign-born”), residents and employees of high-risk congregate settings (such as correctional facilities, long-term care facilities and homeless shelters), health care workers serving patients at high risk of developing TB, and health care workers who have had an unprotected exposure to *M. tuberculosis*.¹ In 2010, 396 (4.1 percent) of 9,666 U.S. adults older than 15 years who reported having active TB and for whom occupational data were available were health care workers.²

In 1994, the Centers for Disease Control and Prevention (CDC) published Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Healthcare Facilities, 1994.³ In 2005, CDC revised the guidelines to reflect the shifts in the epidemiology of TB, advances in scientific understanding and changes in health care practices in the United States. The new guidelines addressed all settings in which

ABSTRACT

Background. The authors describe an investigation of a dental hygienist who developed active pulmonary tuberculosis (TB), worked for several months while infectious and likely transmitted *Mycobacterium tuberculosis* in a dental setting in Washington state.

Methods. Clark County Public Health (CCPH) conducted an epidemiologic investigation of 20 potentially exposed close contacts and 734 direct-care dental patients in 2010.

Results. Of 20 close contacts, one family member and two coworkers, all of whom were from countries in which TB is endemic, had latent TB infection (LTBI). One U.S.-born coworker experienced a tuberculin skin test (TST) conversion from 0 to 8 millimeters. Of the 305 of 731 (41.7 percent) potentially exposed patients who received a single TST, 23 (7.5 percent) had a positive TST result of at least 5 mm. Among the subset of 157 patients tested by CCPH staff, 16 (10.2 percent) had a positive TST result. The dental office did not have infection prevention and control policies related to TB identification, prevention or education.

Conclusions. The coworker’s TST conversion indicated a recent infection, likely owed to occupational transmission. The proportion of dental patients with positive TST results was greater than the 1999-2000 National Health and Nutrition Examination Survey prevalence estimate in the general population, and it may reflect transmission from the hygienist with active TB or a prevalence of LTBI in the community.

Practical Implications. All dental practices should implement administrative procedures for TB identification and control as described in this article, even if none of their patients are known to have TB.

Key Words. *Mycobacterium tuberculosis*; infection prevention and control; contact investigation; dental office; occupational infection; delayed diagnosis.

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health care professionals might work, including dental settings.¹ A decrease in the reports of TB outbreaks in health care settings and health care–associated transmission of TB to patients and health care workers resulted after the introduction of the 1994 infection control guidelines.¹

Risk of transmission in dental settings generally is considered to be low, because few dental health care personnel (DHCP) or patients in the United States would be expected to have TB. Two published reports have documented transmission of *M. tuberculosis* in dental care settings.^{4,5} The authors of the first report confirmed that, although unusual, transmission from an infectious health care provider or patient can occur even when the duration of exposure is no more than an hour (compared with weeks or months).⁴ They reported that in 1979 and 1980, a dentist in the United Kingdom transmitted intraoral and pulmonary *M. tuberculosis* to 15 patients, each of whom had only a single, short exposure to the dentist while undergoing tooth extraction at two school dental clinics.⁴ In 1995, a U.S. hospital-based dental clinic reported finding genetically matching isolates of multidrug-resistant *M. tuberculosis* (MDR TB) in two immunocompromised DHCP.⁵ In that setting, a patient might have transmitted MDR TB to both DHCP, or an unknown source might have transmitted TB to one DHCP who then might have transmitted it to the other DHCP. In this article, we describe an investigation of the case of a dental hygienist who developed pulmonary TB, worked for several months while infectious and likely transmitted *M. tuberculosis* in a dental setting.

CASE REPORT: INDEX CASE

In 2010, a female dental hygienist (Hygienist A) in her mid-40s who was employed in a dental practice with 19 other people in Washington state developed active pulmonary TB disease. Born in a country endemic for TB, she had been living in the United States for more than 20 years. In March 2010, she developed a cough, fever and fatigue and sought medical evaluation from a local private health care provider. The clinician concluded that the symptoms were allergy related. Although Hygienist A continued to have symptoms, including weight loss, she continued to work, occasionally seeking care from her private health care provider. In late July, significant weight loss and fatigue finally prevented her from working and she sought medical care from a second private health care provider. At this visit, her chest radiograph revealed noncavitary bilateral pulmonary infiltrates most confluent in the right upper lobe, consistent with pulmonary TB. In addition, a sputum sample was 4+ smear-positive for acid-fast bacilli, a tuberculin skin test (TST) result was positive at 15 millimeters and a sputum culture was positive for a drug-susceptible *M. tuberculosis*.

In August 2010, the second private health care provider reported the case to Clark County Public Health

(CCPH) in Vancouver, Wash. Hygienist A's medical history included a positive TST result indicating LTBI around the time of her immigration to the United States. However, she never was offered treatment for LTBI and had no history of active TB disease. Hygienist A lived with one family member, her mother, who had been hospitalized for active TB in the 1970s. Hygienist A had no other known risk factors for TB such as diabetes, human immunodeficiency virus infection or possible exposures through a history of drug use, incarceration or homelessness.

Given the clinical evaluation, which revealed a high likelihood of infectiousness, and given that Hygienist A had had close contact with patients and health care staff within a dental office for at least several months while symptomatic, CCPH conducted an epidemiologic investigation. The investigation included identification of potentially exposed contacts, evaluation of these contacts and recommendations for treatment and follow-up. Figure 1 illustrates the timeline from symptom onset through the investigation.

METHODS

Exposure. On the basis of CDC's Guidelines for Preventing the Transmission of *Mycobacterium tuberculosis* in Health-care Settings, 2005,¹ CCPH considered the infectious period as having begun in January 2010, three months before symptom onset, and as having continued through July 2010, when Hygienist A stopped working. We defined exposure on the basis of the time a person spent with Hygienist A, either at home or in the dental office, and we considered close contacts as exposed coworkers and a household member with frequent and prolonged contact interaction with Hygienist A over several months. We decided that the investigation would be expanded to include direct-care patients, who had less exposure, if evidence of transmission was found in any close contact. Even though Hygienist A was wearing a surgical face mask, we considered direct-care patients as being exposed because results from several studies (summarized by the National Institute for Occupational Safety and Health⁶) showed that surgical masks do not provide adequate protection in filtering out the *M. tuberculosis* organism.

Study population and exposure outcome definition. The study population included 754 people potentially exposed to Hygienist A. This included close contacts,

ABBREVIATION KEY. CCPH: Clark County Public Health. CDC: Centers for Disease Control and Prevention. DHCP: Dental health care personnel. LTBI: Latent tuberculosis infection. *M. tuberculosis*: *Mycobacterium tuberculosis*. MDR TB: Multidrug-resistant *Mycobacterium tuberculosis*. NHANES: National Health and Nutrition Examination Survey. NTCA: National Tuberculosis Controllers Association. RP: Respiratory protection. TB: Tuberculosis. TST: Tuberculin skin test.

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